



Risk Assessment at Sediment Sites – Issues, Uncertainties, and Recommended Approaches

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Risk Assessment Framework



- **Must consider unique features of sediments:**
 - Transport/fate process
 - Exposure pathways
 - Site-specific receptors
 - Adverse effects of remediation

Important Processes and Characteristics

Deposition



Resuspension



Mixing

Particle Size

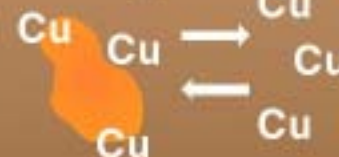


Sand	0.5 mm
Silt	0.064 mm
Clay	0.002 mm

Bioturbation



Diffusion

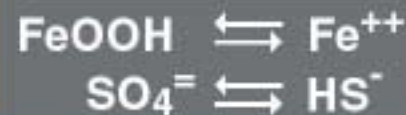


Complexation



Chemical Transformation

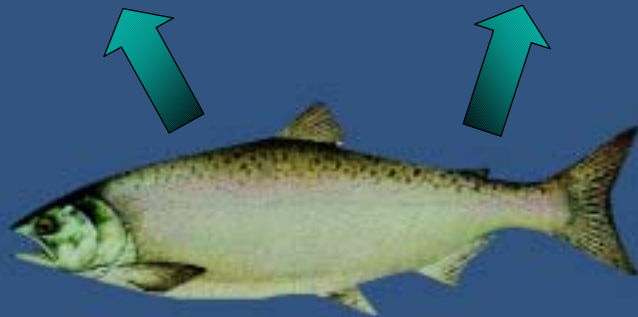
Redox



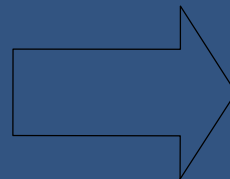


Assessment and Measurement Endpoints Must Be Meaningful to Risk Manager and Form a Sound Basis for Remedial Decision

- Survival
- Growth
- Reproduction
- Population Size
- Enzyme Induction
- Histopathology
- Immunosuppression



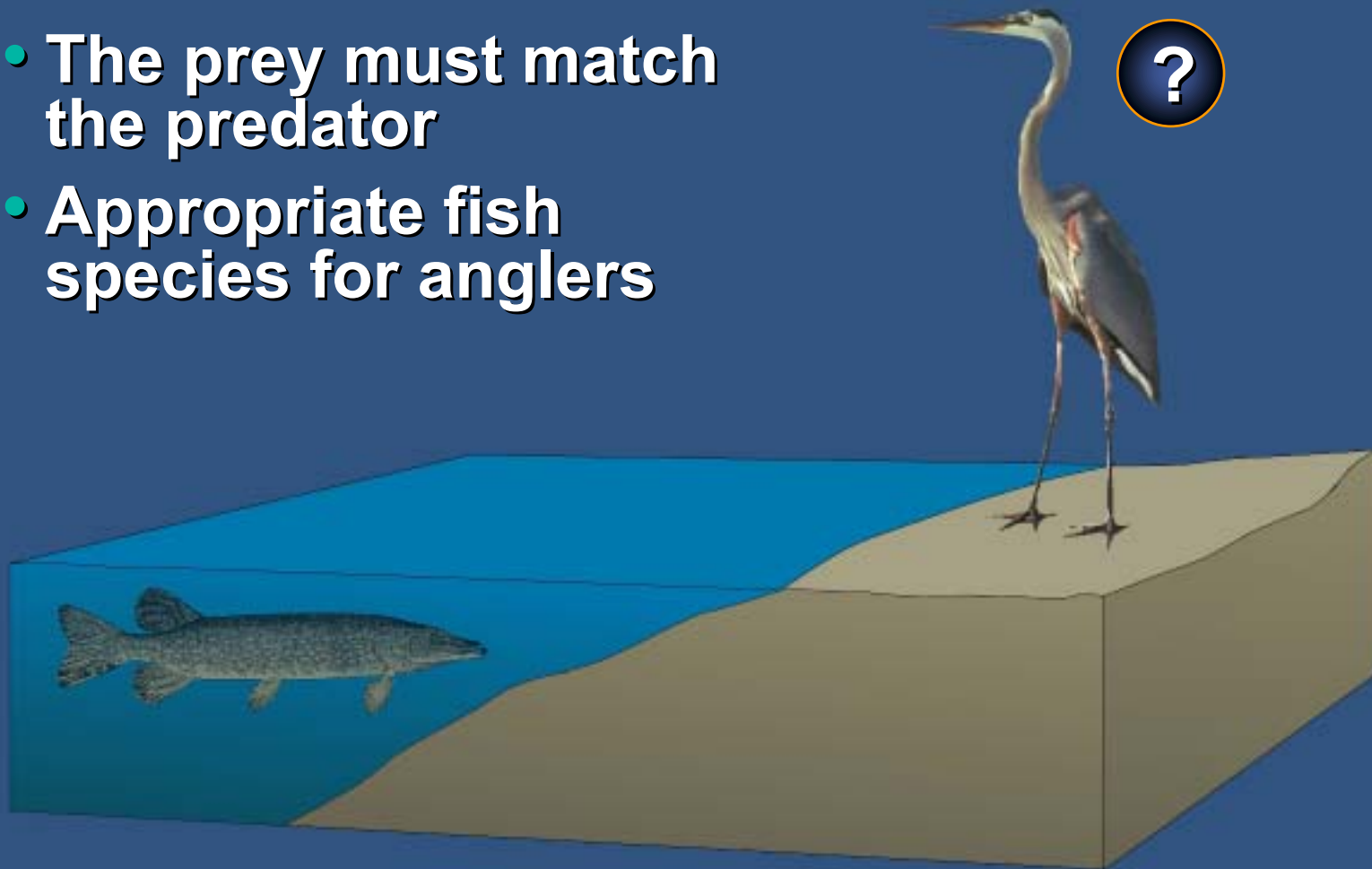
**Assessment
Endpoint**



**Risk
Manager**

Realistic Exposure Pathways

- The prey must match the predator
- Appropriate fish species for anglers



Approaches to Ecological Risk Assessment at Sediment Sites

1 Theoretical – Deterministic Model (TQ)

Use for:

- Screening-level assessments or small, simple sites
- Should use multiple exposure/toxicity scenarios
- Must recognize conservative assumptions and lack of exposure-response relationship
- Second tier probabilistic assessment may be useful

Approach to Ecological Risk Assessment at Sediment Sites

(continued)

2 Empirical

Use for:

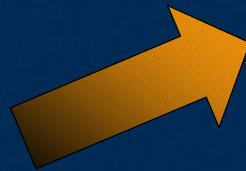
- Larger, complex sites
- Site-specific information on exposure, toxicity, and population effects
- Fish – laboratory studies, population size
- Benthos – triad studies
- Birds and mammals – reproductive performance, population status

Risk to Human Health

- Use site-specific data to estimate exposure
 - Dermal contact
 - Sediment ingestion
 - Angler catch rate
 - Species/size caught

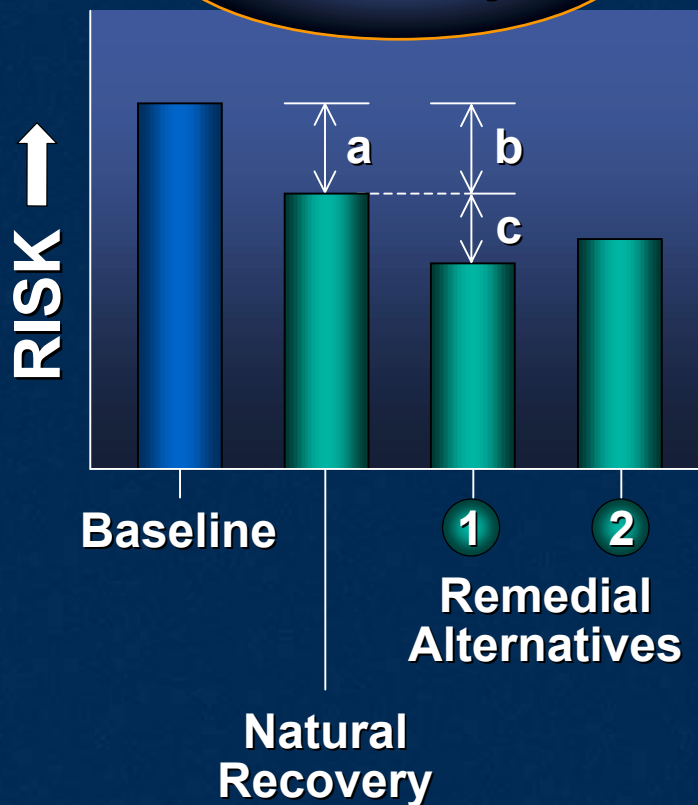


Sediment Remedial Actions Result in Risks of Adverse Effects to Ecological Receptors and to Humans

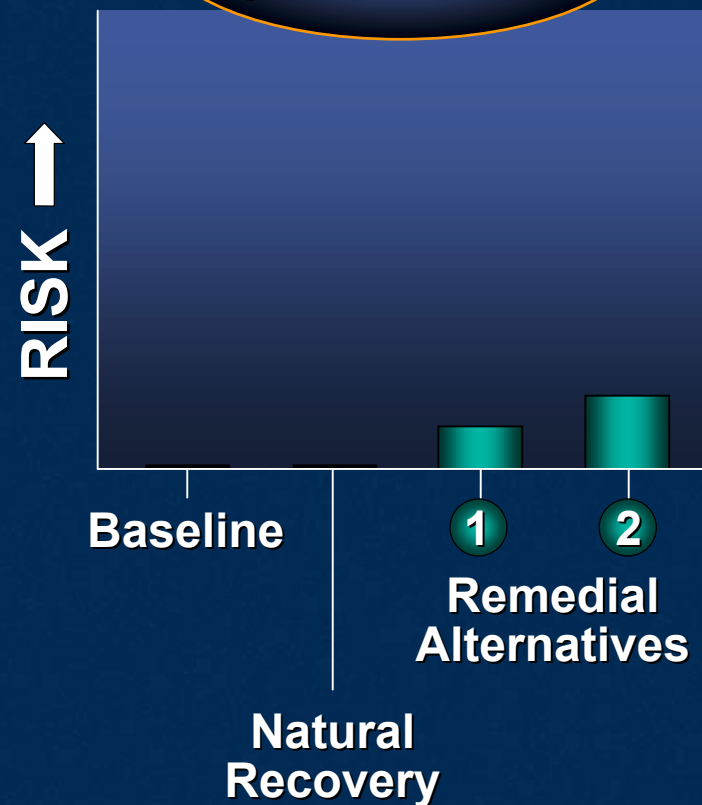


Comparative Risk Analysis

Comparative Risk Analysis



Action-Specific Risks



Risk Management Framework

- **Exposure assessment must consider unique characteristics of sediments and site-specific factors**
- **Assessment and measurement endpoints must be interpretable by the risk manager**
- **Action-specific risks must be considered**
- **Remedial decisions should be based on “net” risks for the site**